To-Do For Detector Checkout

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Outline

I am assuming that the FADC thresholds will be kept as they are now (10 mV except for HMS Cher and SHMS Preshower??)

I am assuming that Pedestal runs have been taken in both spectrometers and the FADC thresholds for all detector channels have been verified

Detector checkout list:

→ Check REF Times leaves for SHMS FADCs: set cut on ref time

→ Check REF Times leaves for HMS FADCs: set cut on ref time

→ Check REF Times leaves for SHMS TDCs: set cut on ref time

→ Check REF Times leaves for HMS TDCs: set cut on ref time

→ Check leaves of TdcAdcTimeDiff for all detectors and set cut for selection of FADCs good hit

→ Check leaves of TdcTime for all detectors and set cuts to ensure selection of TDCs good hit

→ Check Hodoscope, DC, and Calorimeter calibrations in both spectrometers; if not good, calibrate

Outline

Now we can start setting up the PID Trigger legs thresholds

→ Check again the SHMS PRLO, PRHI, CHER and the HMS PRLO, PRHI, SHLO, CHER on the scope with and without beam and take pictures

→ Check again the thresholds for each PID leg; they should be as given below

→ Take ¾ runs in both spectrometers and make plots of npeSum and etottracknorm with delta cuts (do calo calib., if needed); start with the following thresholds for the PID legs:

HMS	**SHMS**
CHER = 11 mV	**CHER = 10 mV**
SHLO = 57mV	**PRLO = 10 mV**
PRLO = 27 mV	**PRHI = 15 mV**
PRHI = 26 mV	

→ Check the electron eff. and the pion rejection by placing cuts on the TDC PID legs; do so for a run with low pi/e and for a run with high pi/e

→ If the electron eff. for ELREAL is >99.9 % and the pion rejection is at least 5, then we are done; also the per PID leg elec. eff. should be high (>~99.9%)

Selection of good TDC and FADC REFERENCE TIMES

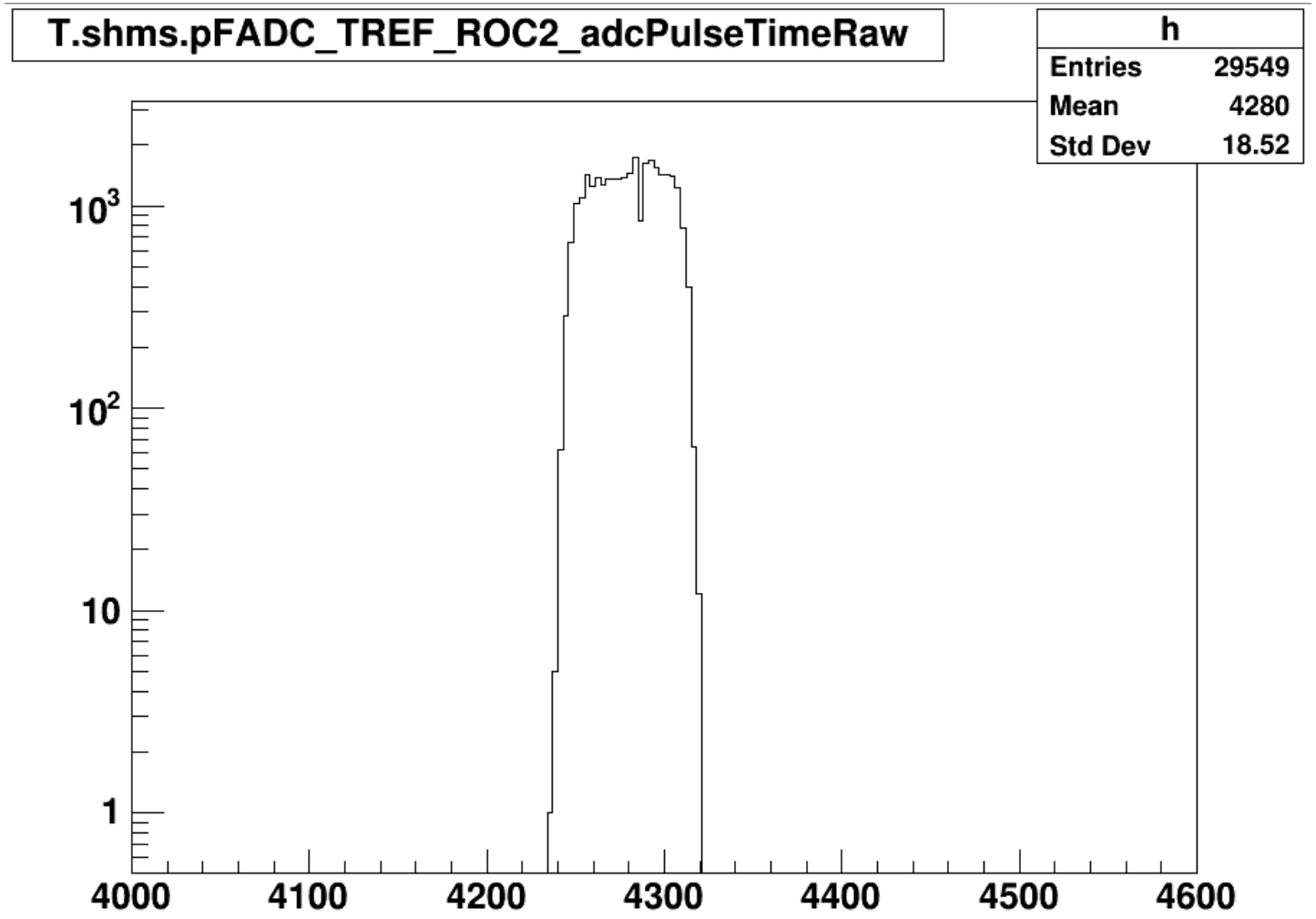
Reference Times Checks: SHMS FADCs

SHMS detectors: FADCs

Detector	Roc, Slot Chan	Type	Trigger Name
Heavy Gas cerenkov	2,14,11	FADC time Refindex = 3	T.shms.pFADC_TREF_ROC2
Aerogel	2,14,11	FADC time Refindex = 3	T.shms.pFADC_TREF_ROC2
Preshower	2,14,11	FADC time Refindex = 3	T.shms.pFADC_TREF_ROC2
Shower	2,14,11	FADC time Refindex = 3	T.shms.pFADC_TREF_ROC2
Trig ADC	2,14,11	FADC time Refindex = 3	T.shms.pFADC_TREF_ROC2
Drift Chamber	6,6,79	TDC time REfchan=79	T.shms.pDCREF1
Drift Chamber	6,7,79	TDC time REfchan=79	T.shms.pDCREF2
Drift Chamber	6,8,79	TDC time REfchan=79	T.shms.pDCREF3
Drift Chamber	6,9,79	TDC time REfchan=79	T.shms.pDCREF4
Drift Chamber	6,10,79	TDC time REfchan=79	T.shms.pDCREF5
Drift Chamber	6,11,47	TDC time REfchan=47	T.shms.pDCREF6
Drift Chamber	6,12,47	TDC time REfchan=47	T.shms.pDCREF7
Drift Chamber	6,13,47	TDC time REfchan=47	T.shms.pDCREF8
Drift Chamber	6,14,15	TDC time REfchan=15	T.shms.pDCREF9
Drift Chamber	6,15,47	TDC time REfchan=47	T.shms.pDCREF10
Hodoscope ADC	2,14,11	FADC time REFINDEX=3	T.shms.pFADC_TREF_ROC2
Hodoscope TDC	2,20,15	TDC time REFINDEX=0	T.shms.pT1
Hodoscope 2YT +TDC	2,19,31	TDC time REFINDEX=1	T.shms.pT2
Trig T1	2 20 15	TDC time REFINDEX=1	T.shms.pT1
Trig T2	2 19 31	TDC time REFINDEX=0	T.shms.pT2

Reference Times Checks: SHMS FADCs

SHMS detectors: FADCs



Param File Location : PARAM / SHMS /GEN / p_reftime_cut.param

; Cut is on reference time per detector.
phodo_adcrefcut = -187.5/.0625
pngcer_adcrefcut = -187.5/.0625
phgcer_adcrefcut = -187.5/.0625
paero_adcrefcut = -187.5/.0625
pcal_adcrefcut = -187.5/.0625

After checking the "T.shms.pFADC_TREF_ROC2_adcPulseTimeRaw" leaf, choose the appropriate cut

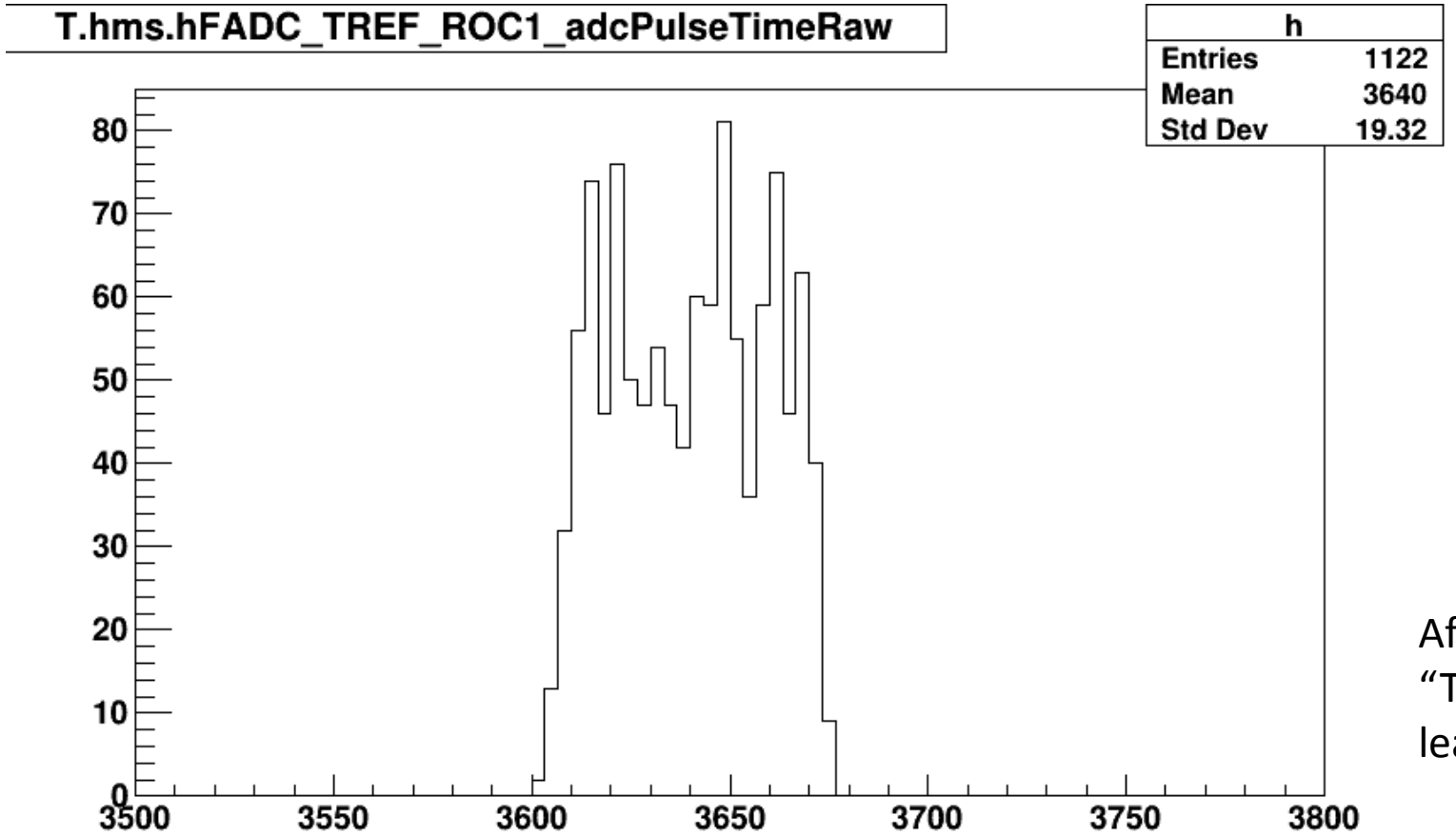
Reference Times Checks: HMS FADCs

HMS detectors: FADCs

Detector	Roc, Slot Chan	Type	Trigger Name
Gas cerenkov	1,18,11	FADC time Refindex =3	T.hms.hFADC_TREF_ROC1
Shower	1,18,11	FADC time Refindex =3	T.hms.hFADC_TREF_ROC1
Drift Chamber	3,8,15	TDC time Refindex=0	T.hms.hDCREF1 (used for all DC)
Drift Chamber	3,4,111	TDC time Refindex=2	T.hms.hDCREF3
Drift Chamber	3,16,63	TDC time Refindex=1	T.hms.hDCREF2
Drift Chamber	3,13,95	TDC time Refindex=3	T.hms.hDCREF4
Hodoscope ADC	1,18,11	FADC time REFINDEX=3	T.hms.hFADC_TREF_ROC1
Hodoscope TDC	1,20,127	TDC time REFINDEX=0	T.hms.hT2
Trig2 TDC	1,20,127	TDC time REFINDEX=1	T.hms.hT2
Trig1 TDC	1,2,6	TDC time REFINDEX=0	T.hms.hT1
Trig ADC	1,18,11	FADC time REFINDEX=3	T.hms.hFADC_TREF_ROC1

Reference Times Checks: HMS FADCs

HMS detectors: FADCs



Param File Location : PARAM / HMS /GEN / h_reftime_cut.param;

Cut is on reference time per detector

hhodo_adcrefcut = -187.5/.0625
hcer_adcrefcut = -187.5/.0625
hcal_adcrefcut = -187.5/.0625

After checking the "T.hms.hFADC_TREF_ROC1_adcPulseTimeRaw" leaf, choose the appropriate cut

Reference Times Checks: SHMS, HMS TDCs

→ Same idea and look at the following (with leaf extension _tdcTimeRaw):

Drift Chamber	6,6,79	TDC time REfchan=79	T.shms.pDCREF1
Drift Chamber	6,7,79	TDC time REfchan=79	T.shms.pDCREF2
Drift Chamber	6,8,79	TDC time REfchan=79	T.shms.pDCREF3
Drift Chamber	6,9,79	TDC time REfchan=79	T.shms.pDCREF4
Drift Chamber	6,10,79	TDC time REfchan=79	T.shms.pDCREF5
Drift Chamber	6,11,47	TDC time REfchan=47	T.shms.pDCREF6
Drift Chamber	6,12,47	TDC time REfchan=47	T.shms.pDCREF7
Drift Chamber	6,13,47	TDC time REfchan=47	T.shms.pDCREF8
Drift Chamber	6,14,15	TDC time REfchan=15	T.shms.pDCREF9
Drift Chamber	6,15,47	TDC time REfchan=47	T.shms.pDCREF10

Hodoscope TDC	2,20,15	TDC time REFINDEX=0	T.shms.pT1
Hodoscope 2YT +TDC	2,19,31	TDC time REFINDEX=1	T.shms.pT2

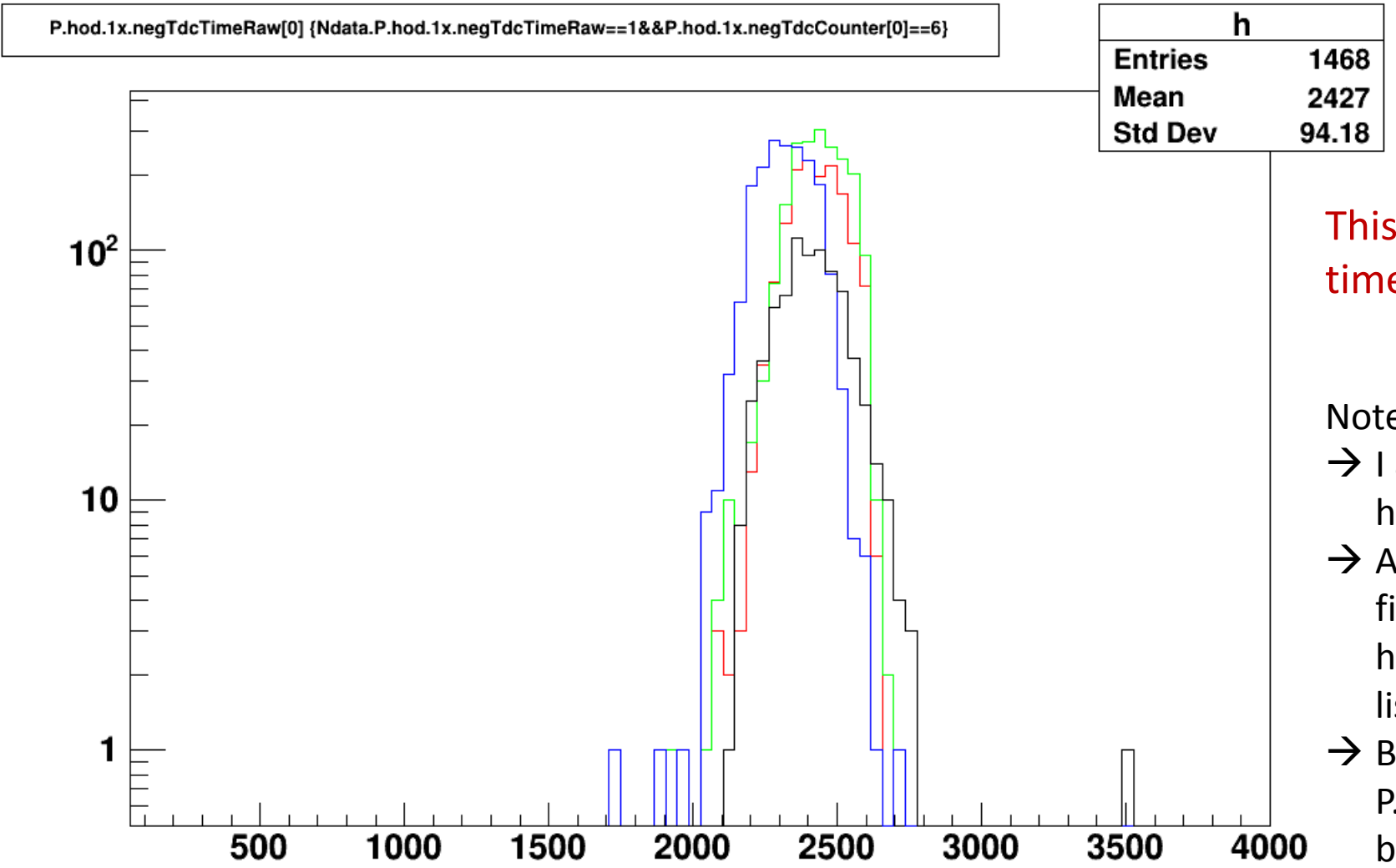
Drift Chamber	3,8,15	TDC time Refindex=0	T.hms.hDCREF1 (used for all DC)
Drift Chamber	3,4,111	TDC time Refindex=2	T.hms.hDCREF3
Drift Chamber	3,16,63	TDC time Refindex=1	T.hms.hDCREF2
Drift Chamber	3,13,95	TDC time Refindex=3	T.hms.hDCREF4

Hodoscope TDC	1,20,127	TDC time REFINDEX=0	T.hms.hT2

Selection of good TDC and FADC hits

Selection of good TDC and FADC hits

Getting the TDC Good Hit: SHMS TDCs, HODO



This is the TDC raw time, **no** reference time subtraction applied

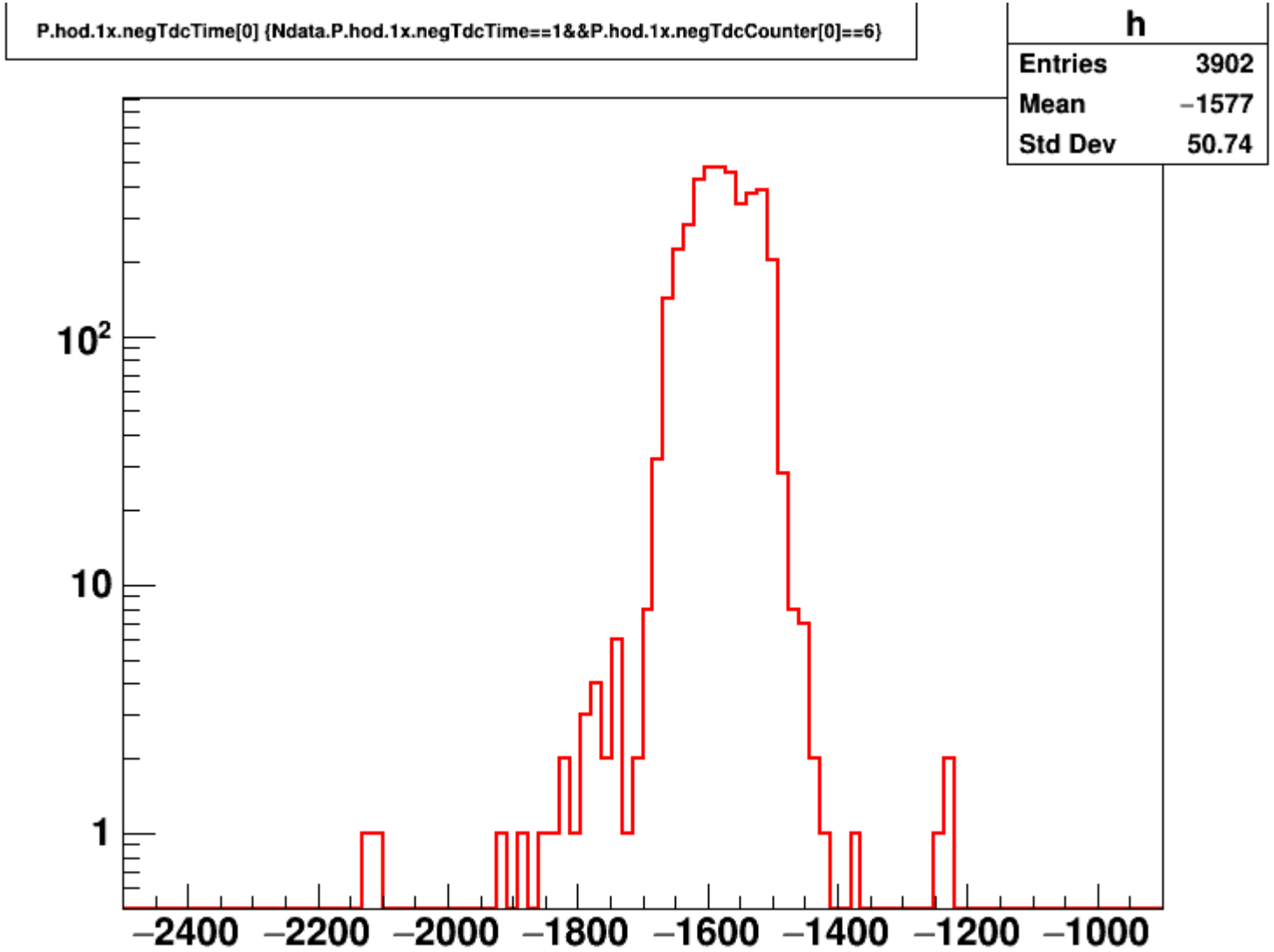
Note to self:

→ I am looking here at events with only one hit (Ndata.P.hod.1x.negTdcTimeRaw == 1)

→ And at events where PMT 6 in plane 1x fired (P.hod.1x.negTdcCounter[0] == 6, [0] here means the first (and only) hit in the list)

→ Both P.hod.1x.negTdcTimeRaw and P.hod.1x.negTdcCounter are arrays indexed by the hits in the hit list

Getting the TDC Good Hit: SHMS TDCs, HODO



This is the TDC time, **with** reference time subtraction applied

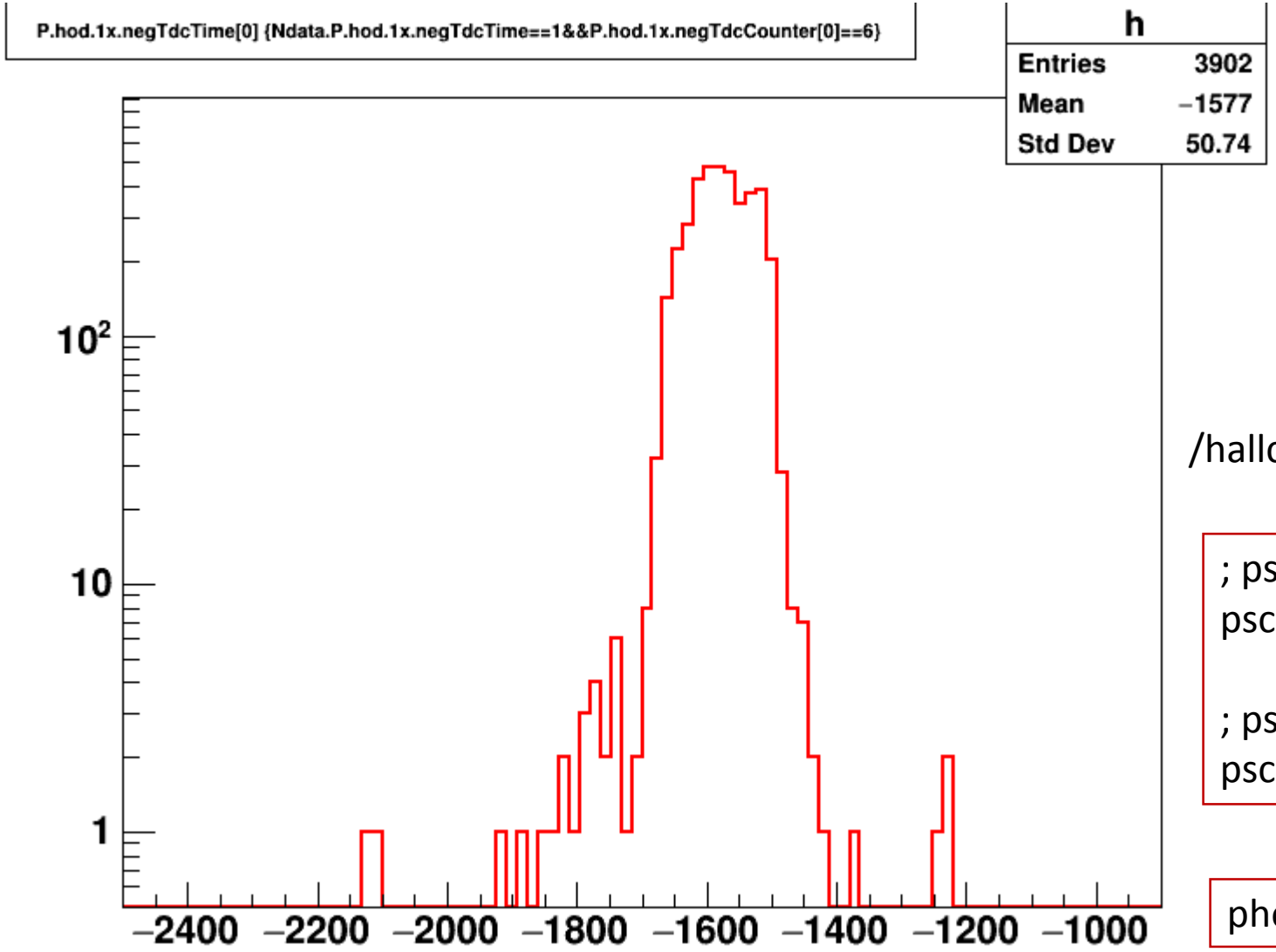
Note to self:

→ I am looking here at events with only one hit (Ndata.P.hod.1x.negTdcTime == 1)

→ And at events where PMT 6 in plane 1x fired (P.hod.1x.negTdcCounter[0] == 6, [0] here means the first (and only) hit in the list)

→ Both P.hod.1x.negTdcTime and P.hod.1x.negTdcCounter are arrays indexed by the hits in the hit list

Getting the TDC Good Hit: SHMS TDCs, HODO



Cuts applied to TdcTime+TdcOffset to select the good hit in the TDCs (still in channels at this point)

TdcOffset same for all 4 planes

/hallc_replay/PARAM/SHMS/HODO/phodo_cuts.param

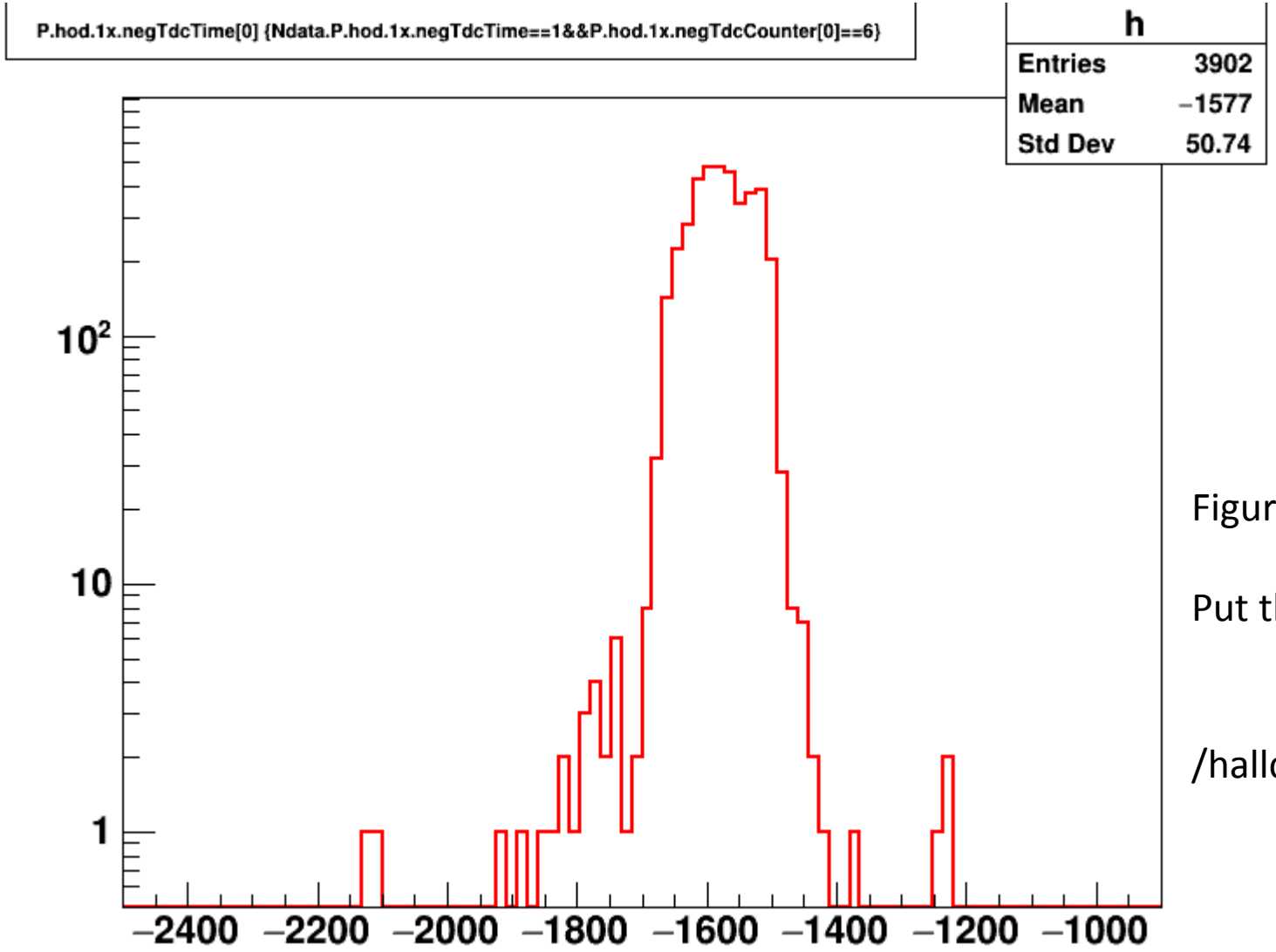
```
; pscin_tdc_min       minimum tdc value in hms scin
pscin_tdc_min = -500

; pscin_tdc_max       maximum allowed tdc value
pscin_tdc_max = 1000
```

cuts

```
phodo_tdc_offset = 2000, 2000, 2000, 2000
```

offset

Getting the TDC Good Hit: SHMS TDCs, HODO



Cuts applied to TdcTime+TdcOffset to select the good hit in the TDCs (still in channels at this point)

TdcOffset same for all 4 planes

Figure out appropriate cuts to select the prompt peak

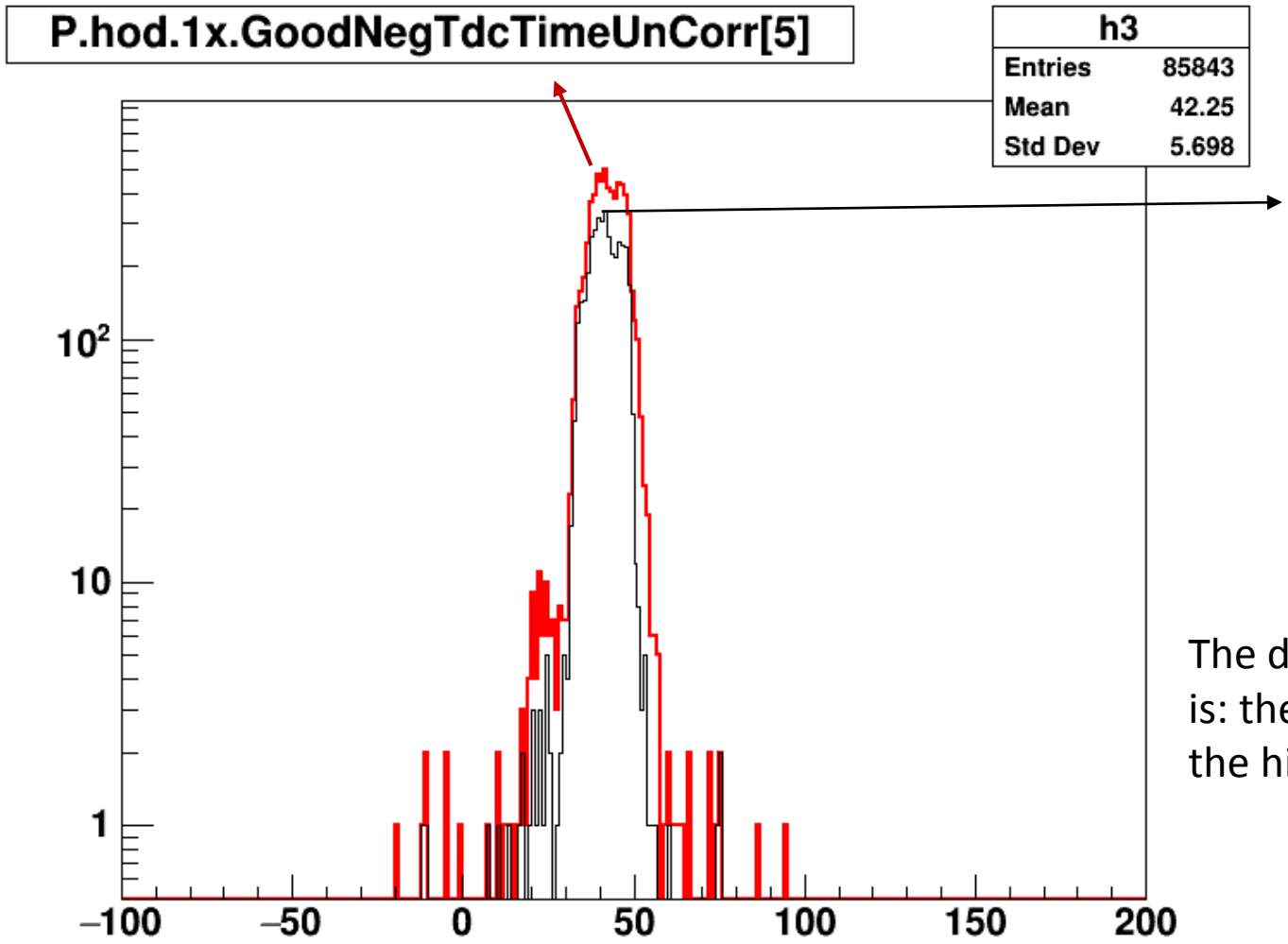
Put those cuts in:

/hallc_replay/PARAM/SHMS/HODO/phodo_cuts.param

Then replay

Getting the TDC Good Hit: SHMS TDCs, HODO

Check that the cuts were chosen correctly by looking at the leaf that shows the selection of good hits:

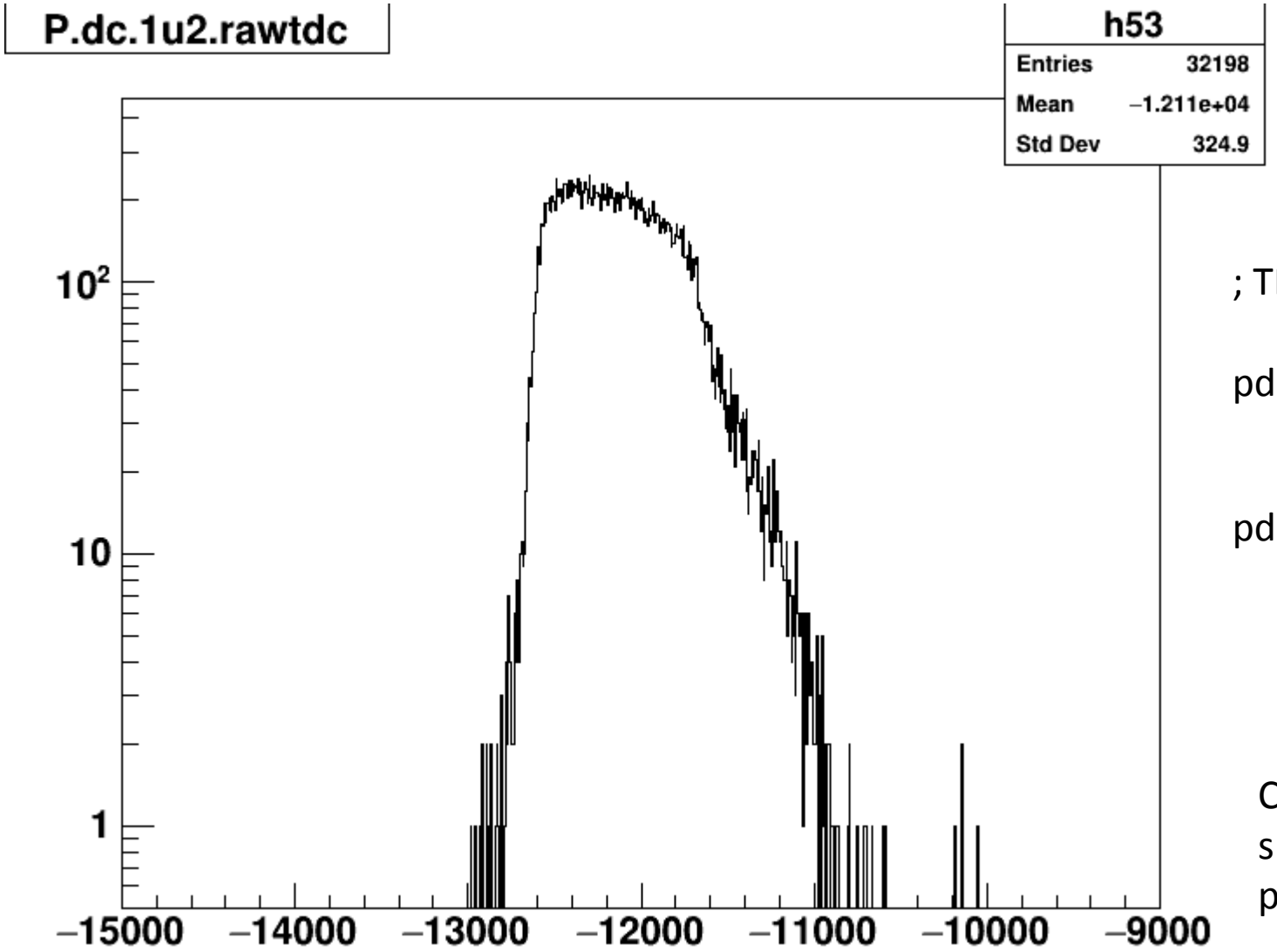


T>Draw("P.hod.1x.GoodNegTdcTimeUnCorr[5]>>h4(300,100.,200.)","Ndata.P.hod.1x.negTdcTime==1"

Command above (looking at the good time when only one hit is present per event) can be used to figure out quickly the cuts

The difference between this leaf and P.hod.1x.negTdcTime is: the offset, the conversion from channels to ns and also the hit selection

Getting the TDC Good Hit: SHMS TDCs, DC



/hallc_replay/PARAM/SHMS/DC/pdc_cuts.param

; TDC window limits for each plane.

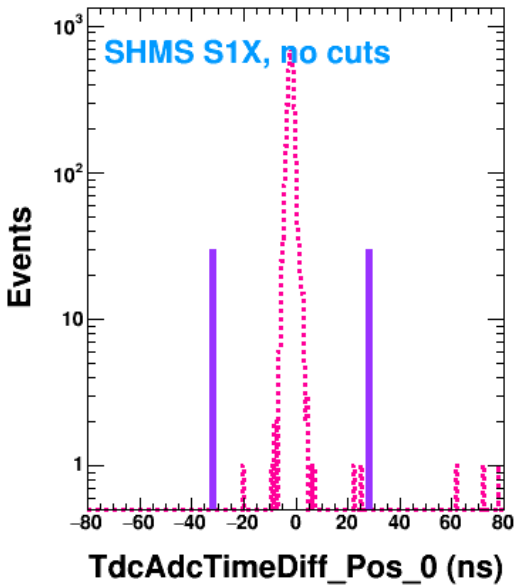
pdc_tdc_min_win =
-13000, -13000, -13000, -13000, -13000, -13000
-13000, -13000, -13000, -13000, -13000, -13000

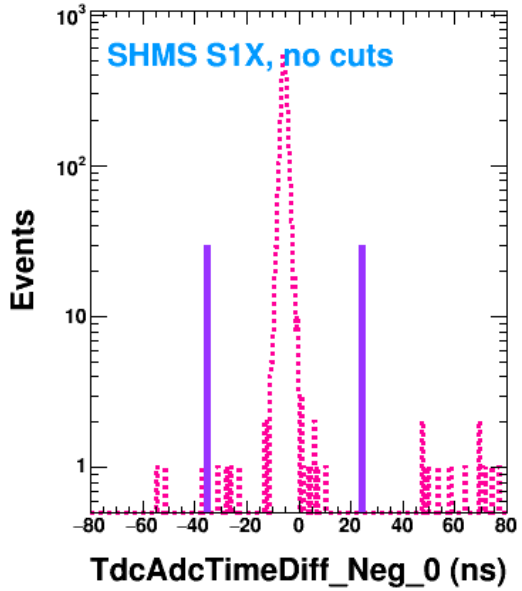
pdc_tdc_max_win =
-10000, -10000, -10000, -10000, -10000, -10000
-10000, -10000, -10000, -10000, -10000, -10000

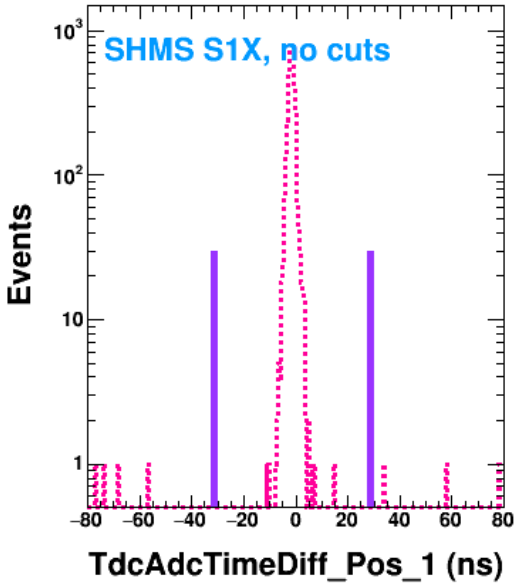
Change these cuts based on plots like the one shown (superimpose histograms for all planes per chamber)

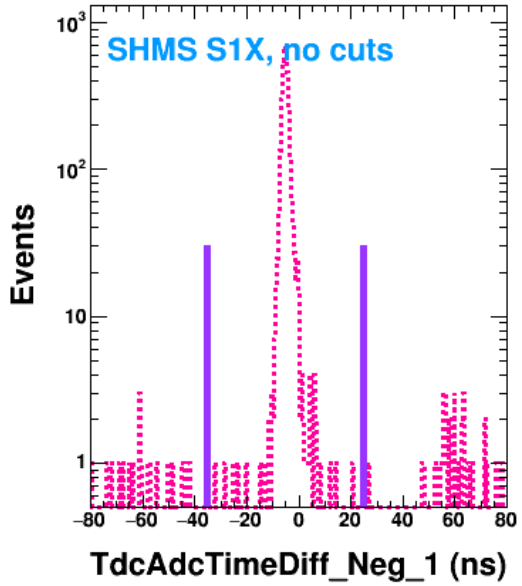
Selection of good TDC and FADC hits

Getting the FADC Good Hit: SHMS FADCs, HODO





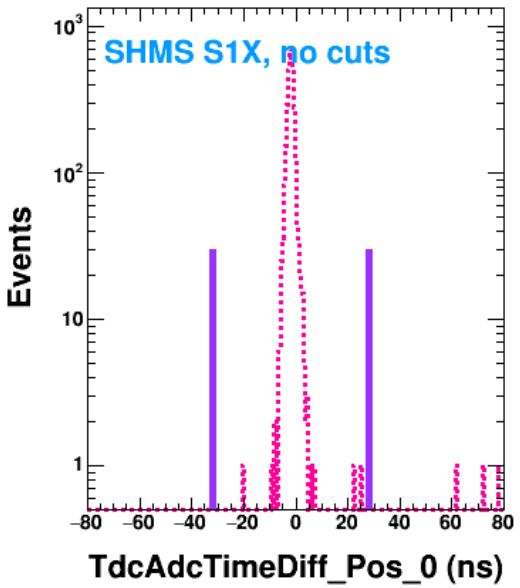


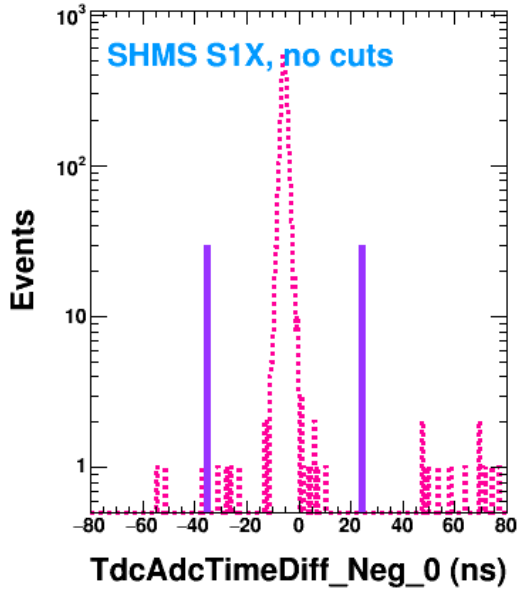


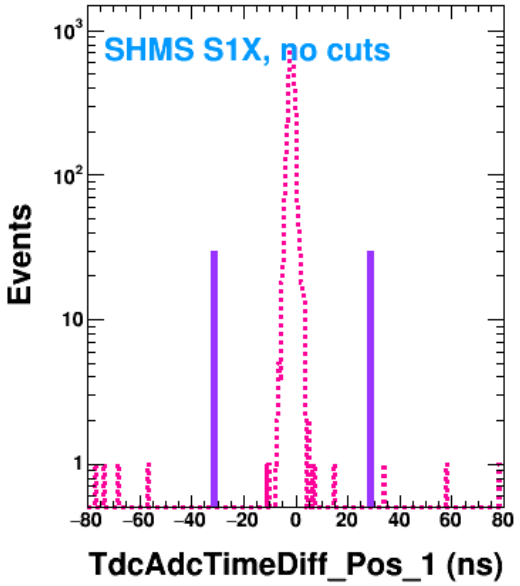
Run script:
/simona/analysis/timing_study/clean/s1x/s1x_time_diff.C

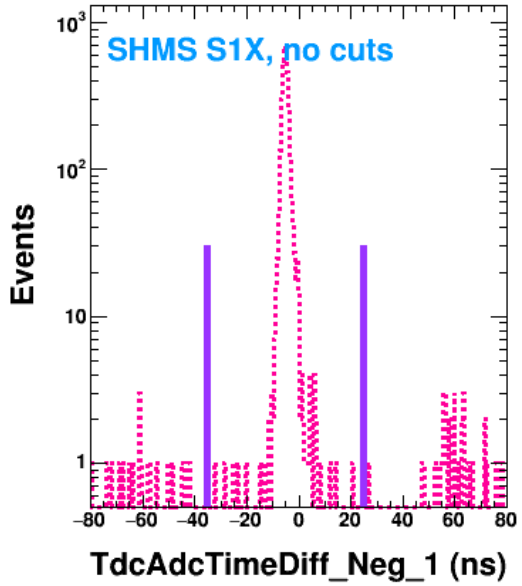
	S1X_NEG			S1X_POS	
0	-35.5	24.5	0	-32	28
1	-35	25	1	-31.5	28.5
2	-35	25	2	-27.5	32.5
3	-38.5	21.5	3	-28.5	31.5
4	-39	21	4	-28	32
5	-35.5	24.5	5	-27.5	32.5
6	-35	25	6	-27.5	32.5
7	-35.5	24.5	7	-31	29
8	-34.5	25.5	8	-27	33
9	-34.5	25.5	9	-27	33
10	-38	22	10	-27	33
11	-35.5	24.5	11	-28	32
12	-34.5	25.5	12	-27	33

Getting the FADC Good Hit: SHMS FADCs, HODO









Run script:
/simona/analysis/timing_study/clean/s1x/s1x_time_diff.C

Change cuts in:

/hallc_replay/PARAM/SHMS/HODO/phodo_cuts.param

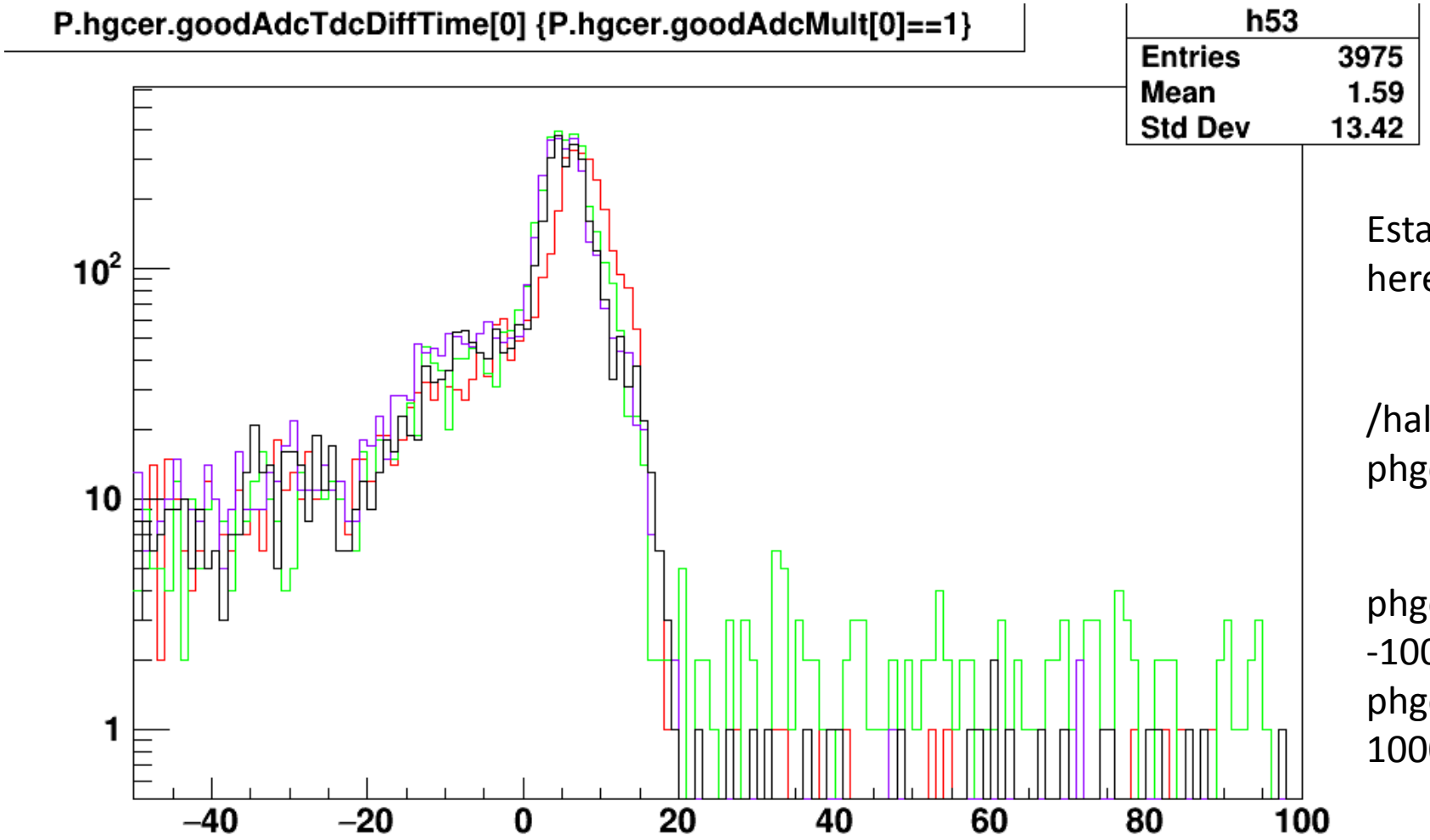
phodo_PosAdcTimeWindowMin = -200., -200., -200., -200.,
-200., -200., -200., -200.,
.....

phodo_PosAdcTimeWindowMax = -200., -200., -200., -200.,
-200., -200., -200., -200.,
.....

phodo_NegAdcTimeWindowMin = -200., -200., -200., -200.,
-200., -200., -200., -200.,
.....

phodo_NegAdcTimeWindowMax = -200., -200., -200., -200.,
-200., -200., -200., -200.,
.....

Getting the FADC Good Hit: SHMS FADCs, CHER

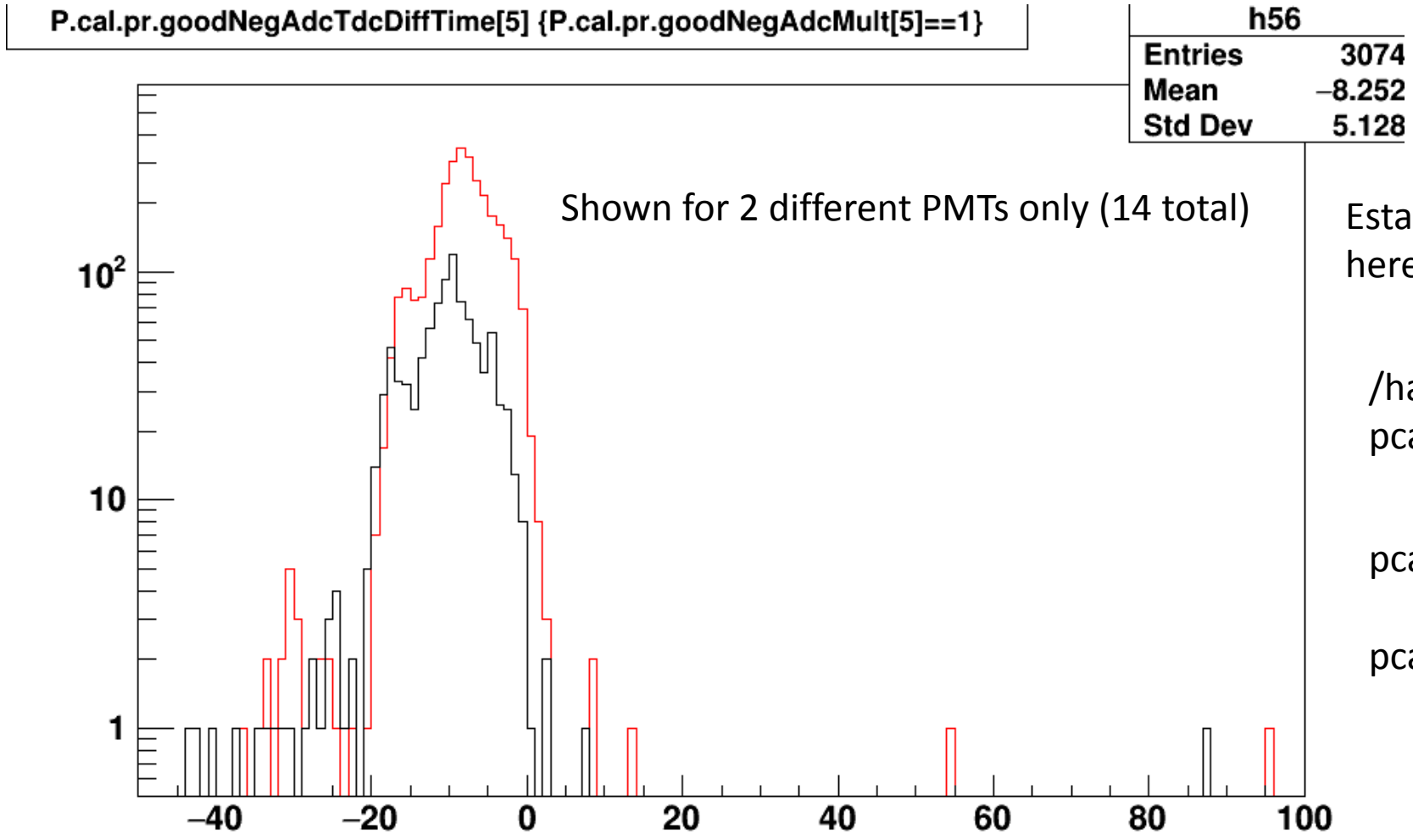


Establish cuts by looking at the plot shown here and change the parameter file:

/hallc_replay/PARAM/SHMS/HGCER/
phgcer_cuts.param

phgcer_adcTimeWindowMin =
-1000.0, -1000.0, -1000.0, -1000.0
phgcer_adcTimeWindowMax =
1000.0, 1000.0, 1000.0, 1000.0

Getting the FADC Good Hit: SHMS FADCs, PRSHOWER



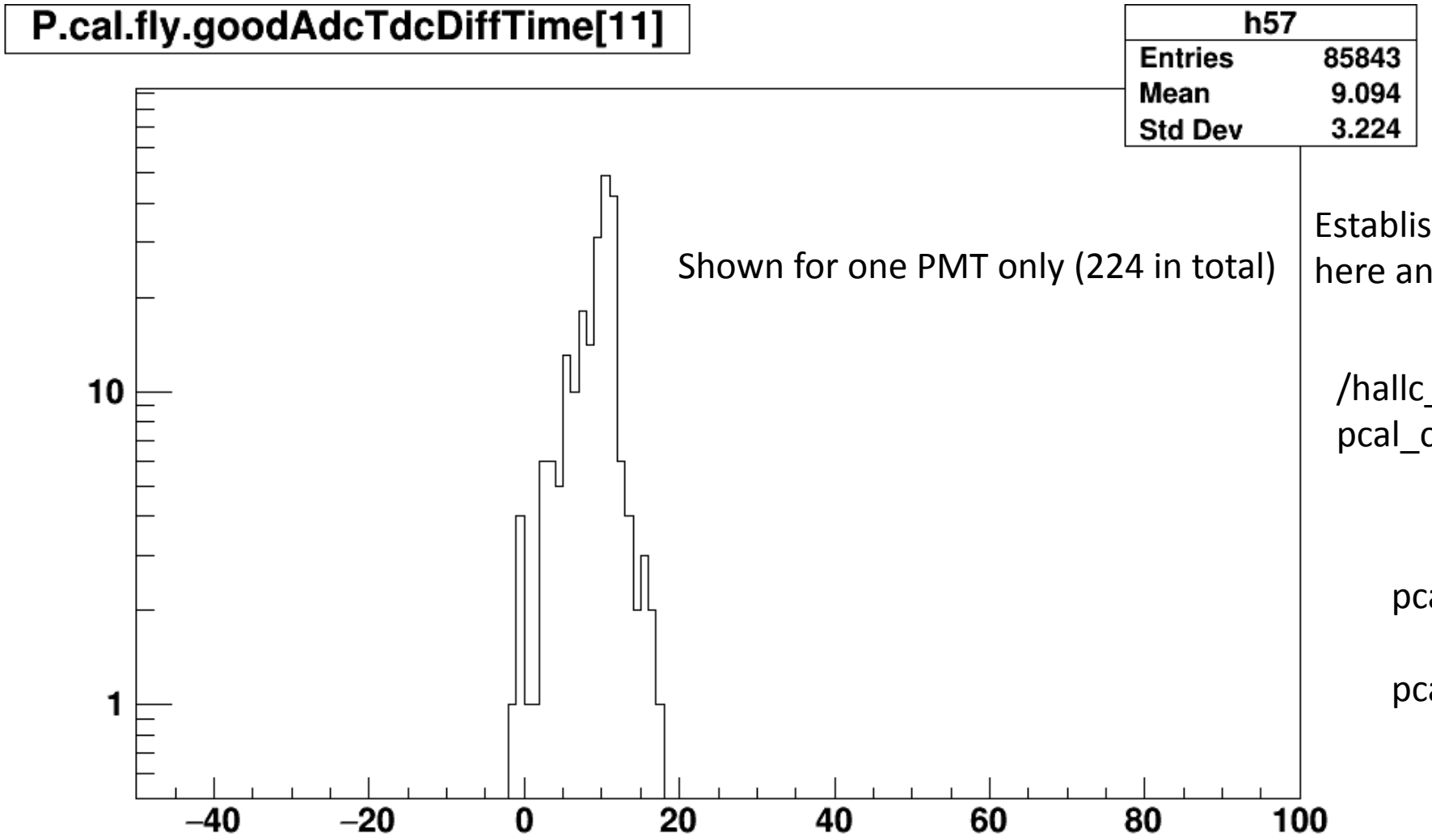
Establish cuts by looking at the plot shown here and change the parameter file:

/hallc_replay/PARAM/SHMS/CAL/pcal_cuts.param

pcal_pos_AdcTimeWindowMin

pcal_pos_AdcTimeWindowMax

Getting the FADC Good Hit: SHMS FADCs, SHOWER



Shown for one PMT only (224 in total)

Establish cuts by looking at the plot shown here and change the parameter file:

/hallc_replay/PARAM/SHMS/CAL/
pcal_cuts.param

pcal_arr_AdcTimeWindowMin

pcal_arr_AdcTimeWindowMax

PID LEGS

Calorimeter PID LEGS: HMS

→ To check the electron “eff.” of the calorimeter trigger PID legs, electrons are selected with a delta cut and a Cherenkov cut_npe > 1

→ Then the “eff.” is defines as ratio of events:

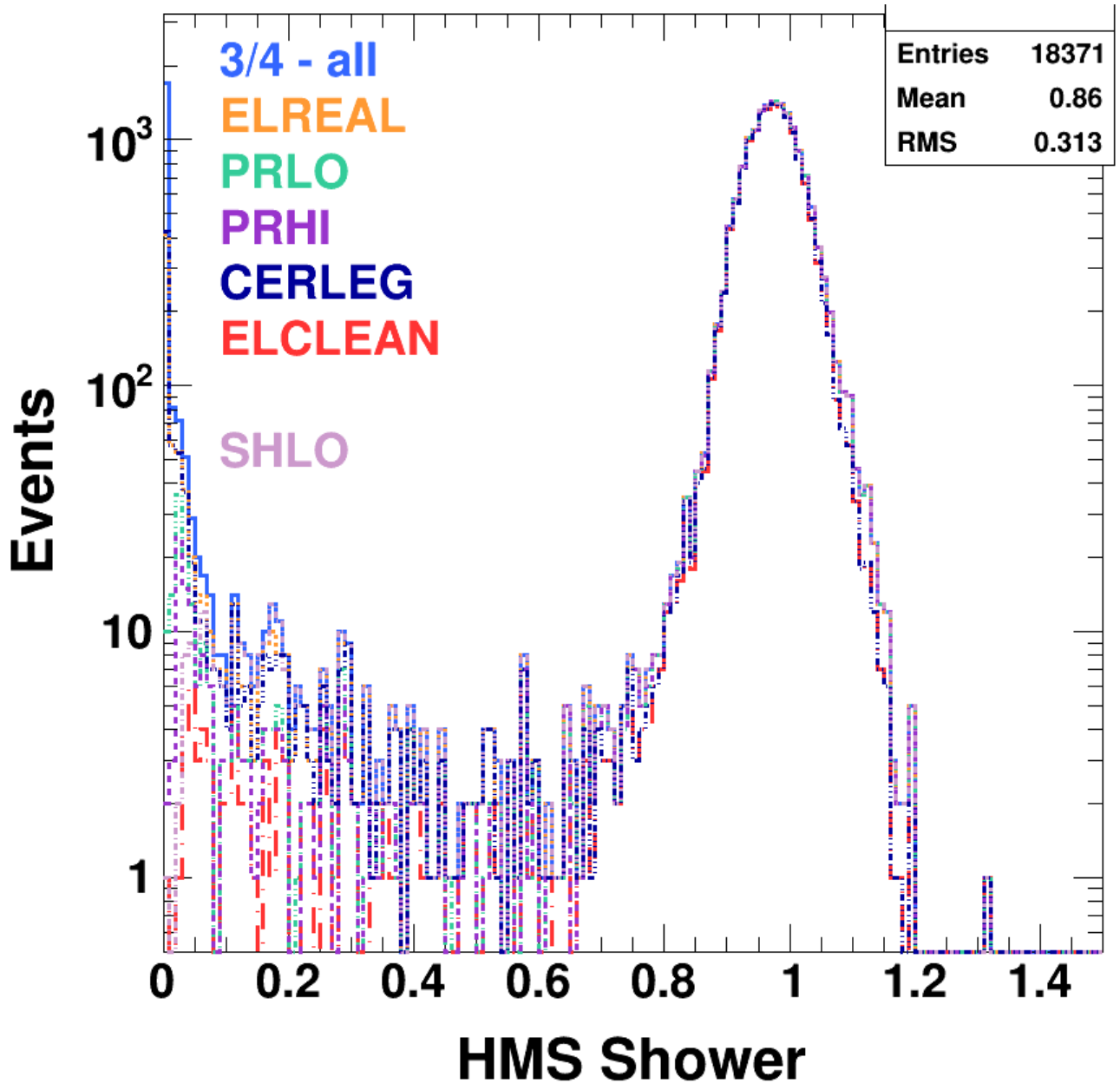
(TDC_LEG>0. and etottracknorm > 0.7 and etottracknorm < 1.3)/(etottracknorm > 0.7 and etottracknorm < 1.3)

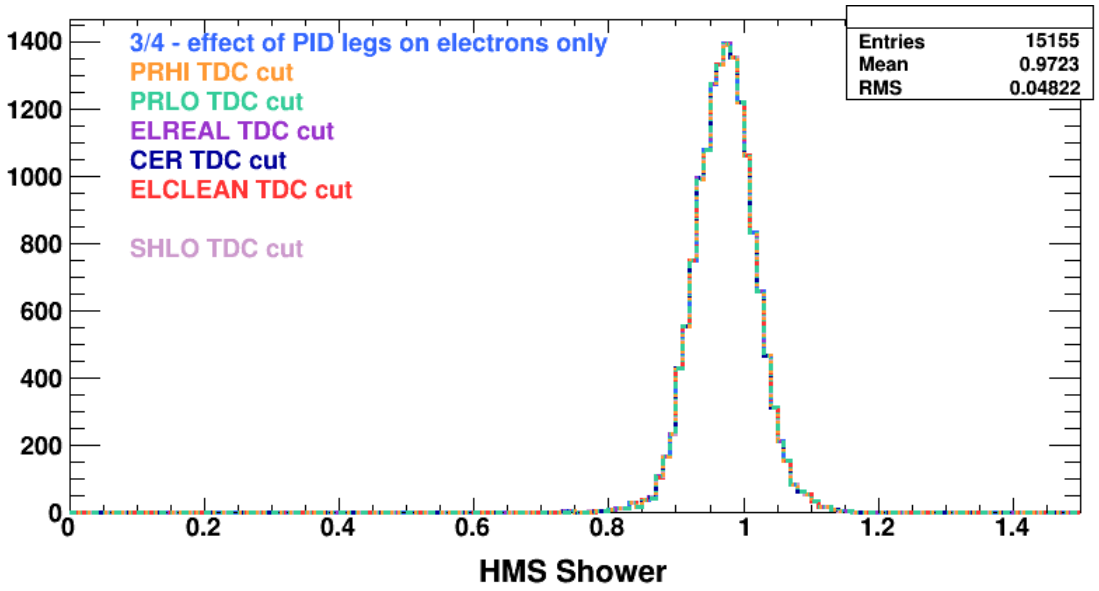
→ To check the pion rejection of the calorimeter trigger PID legs, pions are selected with a delta cut and a Cherenkov cut_npe == 0

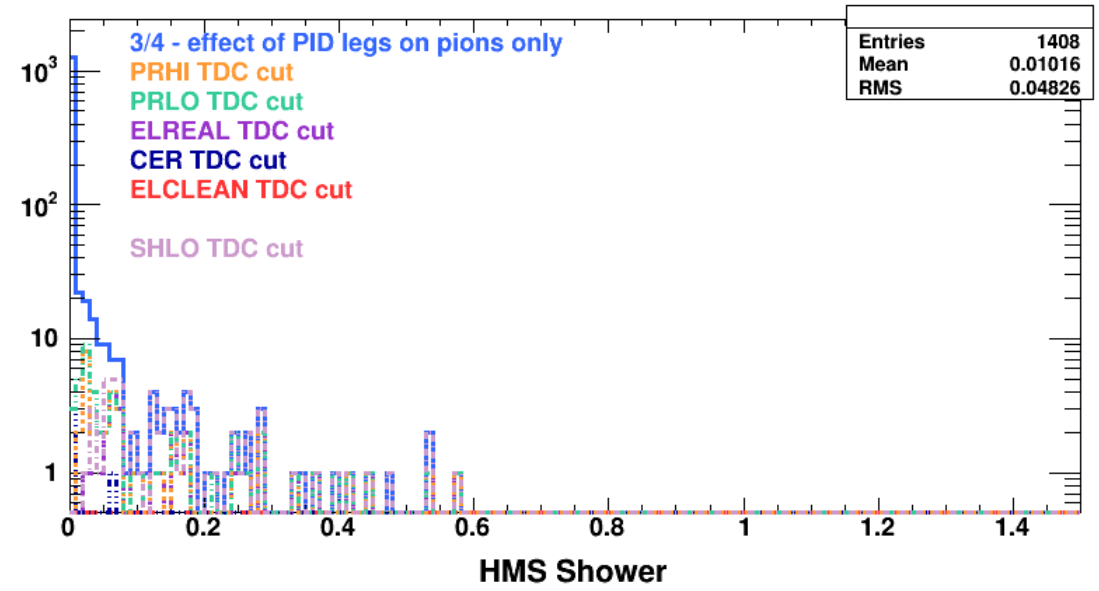
→ Then the pion rejection is defines as ratio of events:

(etottracknorm > 0.7 and etottracknorm < 1.3)/(TDC_LEG>0. and etottracknorm > 0.7 and etottracknorm < 1.3)

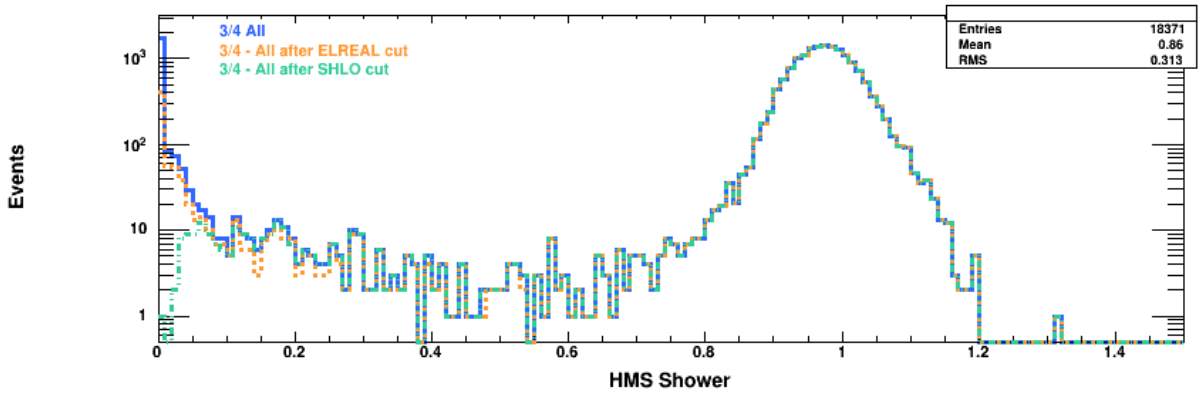
Calorimeter PID LEGS: HMS

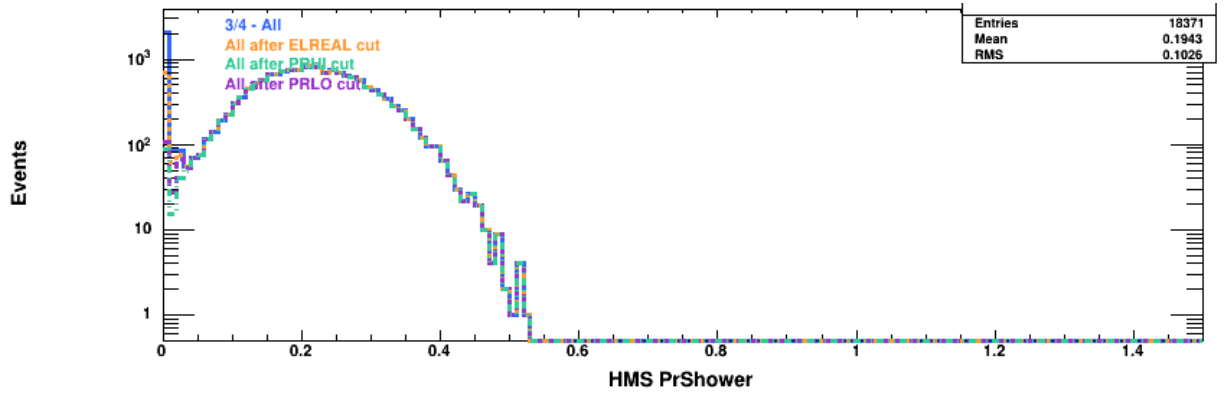


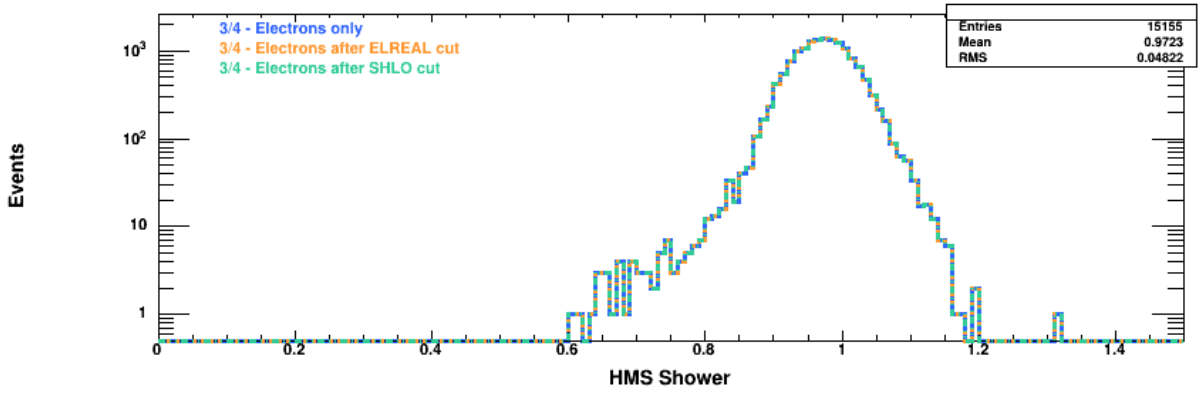


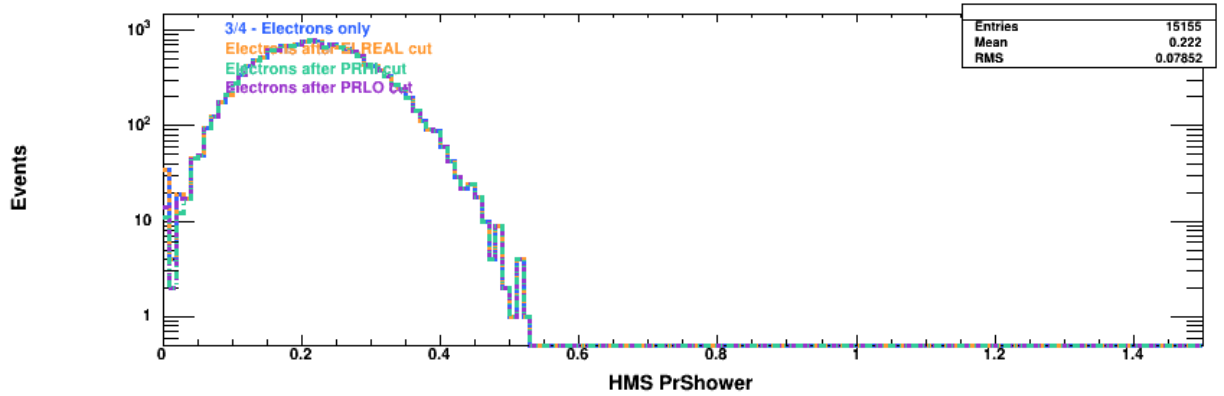


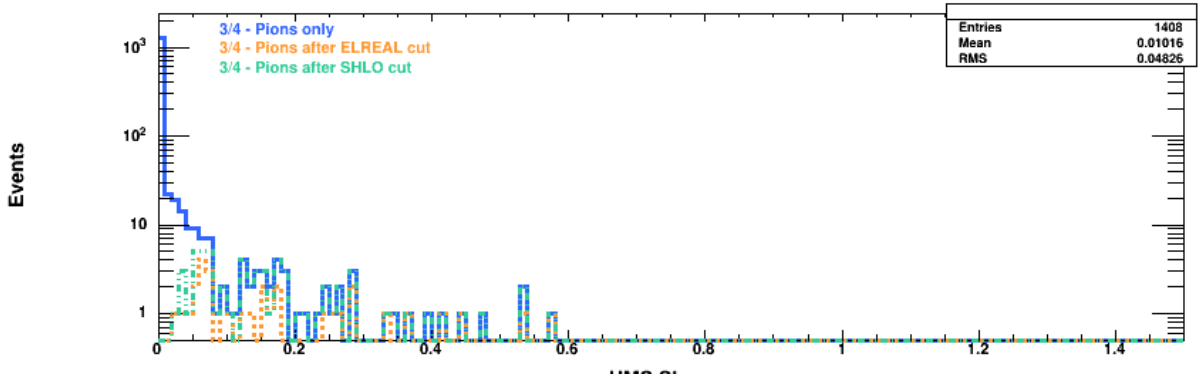
Calorimeter PID LEGS: HMS

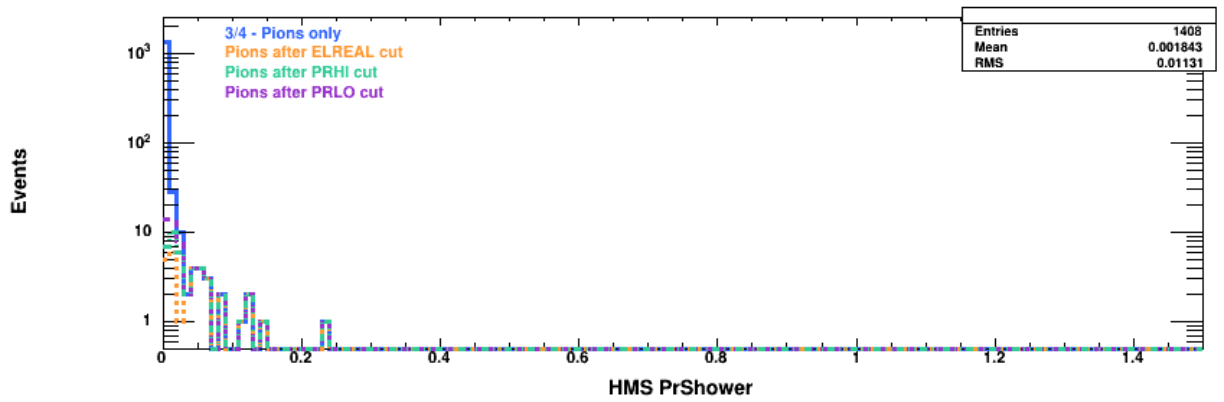




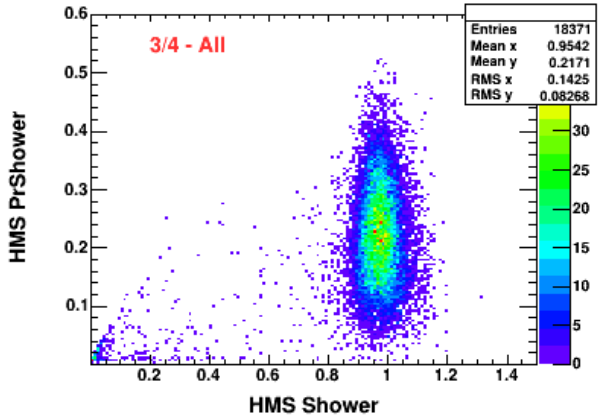


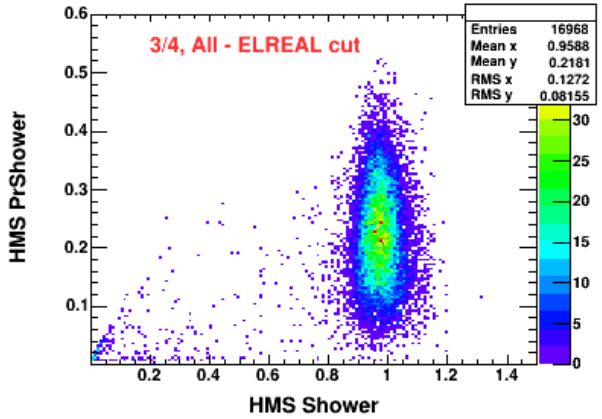


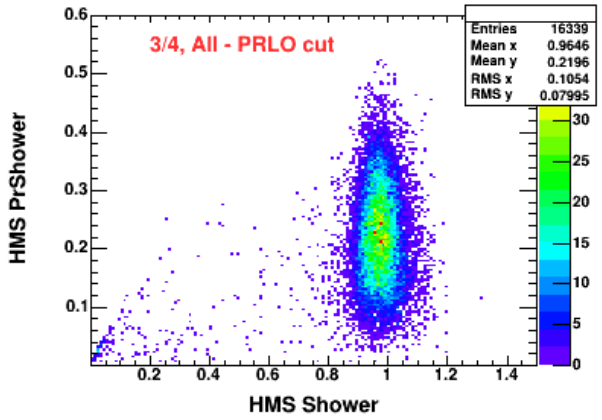


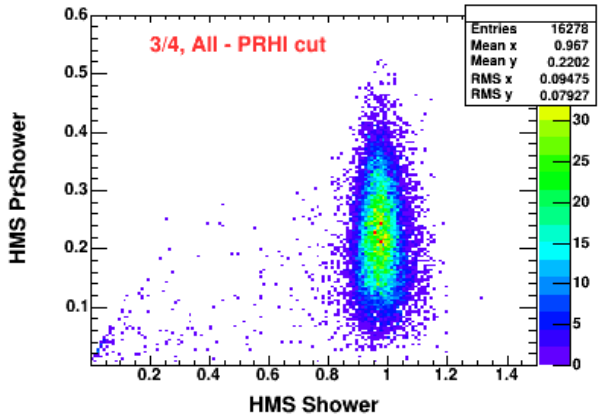


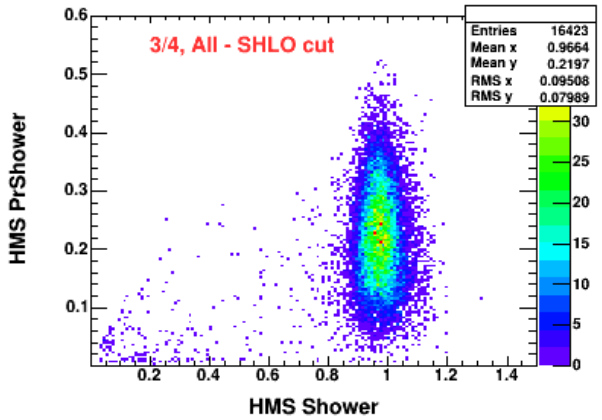
Calorimeter PID LEGS: HMS











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elec eff. shlo: 15139 15139 1
pion rej. shlo: 72 141 1.95833

CHER PID LEGS: HMS

Already et at ~0.5 n.p.e